Data Transmission through Nano Machines using the Clustering Tree for Mobile Adhoc Network

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Abstract—**Mobile Ad hoc Networks (MANET) are normally characterized by high mobility and frequent link failures. With our previous work Optimization of Nano Adhoc on Demand distance Vector routing protocol in manet (O-NAODV) we incorporated clustering technique and designed a new routing protocol called Enhanced NAODV (ENAODV). In manet nanotechnology is constituted by two kinds of nano machines used for sending and receiving of data with base stations. The Base stations(BS) also called info stations to collect the information coming from nano machines are assumed to make decision for an appropriate action in routing through routing tables. In O-NAODV all source nodes needs to send the information to base station which takes more time and data loss on that network. In our new E-NAODV routing protocol the clustering tree is used in which a cluster head collects data from mobile nodes belonging to the cluster and sends the data to the sink node after data aggregation process. To reduce overall communication costs, energy consumption and reduction in delay the cluster head performs data aggregation and then send the data to sink node. Compared with optimized model the enhanced model behaves well in various aspects in the same simulation scenario.**

Keywords - N-ADOV, O-NAODV, E-NAODV, Clustering Tree, BS

I. INTRODUCTION

A manet is enthusiastically self-composed and self-implementing one with nodes in the network by design establish and maintaining connectivity between themselves. A mobile ad hoc network sometimes called a mobile interconnect network, is a self configuring organization of movable devices connected by wireless links. Each piece of equipment in a manet is open to move in competition in any bearing, and will consequently transform its links to other device on a regular basis. Nanotechnology assures new solutions for several applications in biomedical, industrial and military fields. At nanoscale, nanomachines can be considered as the most basic functional unit. Nanomachines are tiny components consisting of an arranged set of molecules, which are able to perform very simple tasks. Nanotechnology can be defined as the processing, separation, consolidation and deformation of resources on atomic or molecular scale. A single nanomachine has very limited capabilities. The interconnection of nanomachines, however, enables to accomplish complex tasks easily. Nano machines (e.g., natural molecules, reproduction devices) correspond to minute strategy or mechanisms that perform computation, sense, or actuation [1].

Molecular statement provides a method for one nano machine to program or decode in sequence into molecules and to propel in sequence to another nano machine. Nano machines previously exist in the outward appearance of natal cells and the substance processes surrounded by those cells. Present by-nanotechnology has highly developed to the summit where manufacturing of organic systems is reasonable, as verified from end to end adjustment of DNA to manufacture new compartment functionality [2, 12, 3].

A. Mobile Ad hoc Network Model

We now consider a model manet consists of a base station (BS), away from the nodes, through which the end user can access data from the Mobile Ad hoc network. All the nodes in the network are homogeneous and begin with the same initial energy. The BS however has a constant power supply and so, has no energy constraints. It can transmit with high power to all the nodes [11,16]. Thus, there is no need for routing from the BS to any specific node. However, the nodes cannot always reply to the BS directly due to their power constraints, resulting in asymmetric communication.

II. PREVIOUS RESEARCH

There are numerous routing protocols been discussed earlier for mobile adhoc network. We explore few of the methods here related to our problem statement. An Enhanced Cluster-tree Routing Algorithm in zigbee Network [4], proposes an improved Cluster-tree routing algorithm to reduce network traffic and enhance efficiency of the whole network. The proposed algorithm allows node to transmit data according to different Cluster Labels, which could decrease the route discoveries. An Enhanced Cluster Based Routing Algorithm for Wireless Mobile Ad hoc Networks [5], proposes, Enhanced CBRP, a schema to improve the cluster stability and in-turn improves the performance of traditional cluster based routing protocol (CBRP), by electing better cluster head using weighted clustering algorithm and considering some crucial routing challenges.

Channel Model and Capacity Analysis of Molecular Communication with Brownian motion [6], analyzes the capacity of a molecular communication channel in a one dimensional environment where information is represented with molecules that are released by a transmitter nano machine, propagate via Brownian motion, degrade over time, and stochastically reach the receiver nano machine. The channel is modeled as a time slotted binary channel, and two modulation schemes are proposed: a naive modulation scheme and an extended modulation scheme with a redundant number of molecules [8]. Enhanced Junction Selection Mechanism for Routing Protocol in VANET [7] presents an enhanced routing protocol specifically designed for city environments. It uses vehicular speed and directional density for dynamic junction selection. Simulation results exhibit increased packet delivery ratio while decreased end-to-end delay when compared with state of the art protocols [9]. An Energy-Aware, Cluster-Based Routing Algorithm for Wireless Mobile Ad hoc Networks [10] propose an Energy Aware Clustered-Based Multipath Routing (EACMR), which forms several clusters, finds energy aware node-disjoint multiple routes from a source to destination and increases the network life time by using optimal routes..

A Physical Channel Model and Analysis for nano scale Molecular communications With Forester Resonance Energy Transfer [13]**,** discusses where the phenomenon yields a significant quantity of structural in sequence about the donor and acceptor two of a kind; therefore, numerous methods based on worry have been developed and used in these areas. For example, using its strong dependence on distance, worries is browbeaten as a spectroscopic sovereign while influential the intermolecular and intermolecular distances and monitor the conformational changes of proteins. Concern is also used in molecular and quantum computing studies as a tool for manufacture of intertwined quantum states [14, 15].

III.PROPOSED APPROACH

The latency and energy loss introduced by the Optimized - Nano Ad hoc On demand Distance Vector routing are removed using the proposed method. In the proposed method E-NAODV instead of forwarding all topology and control details to the base station, one of the nodes in the group or geographic region becomes the cluster head to handle the aggregation process. The cluster head maintains the link states, so that whenever a node has a packet to transmit it can simply verify the link state of the particular path selected using the cluster head. Initially all the nodes replies with the control message which comes from the base station and later a group of clusters are formed to handle the further routing process.. Then network is split in to the two routes, like as Active route and passive route. During the data transmission if there is huge packet loss then the cluster head or base station consider the route as a passive route and will choose different route to perform data transfer.

A. Cluster-Tree Network

The tree routing address assignment mechanism that the Cluster-tree topology uses is like this: The algorithm reduces the flooding to some extent, however, in order to further reduce the network traffic and choose the best routing, we improve the intra-routing and inter-routing respectively. In the intra-routing part, the intermediate node does not directly transfer data packet to its parent or children, but firstly check its neighbor table instead, if the destination address is not in the neighbor table, then apply the routing tree algorithm, otherwise, send data packets directly.

In the inter-routing part, if the address of the destination node related to the nodes of the cluster then the intermediate node simply forwards the packet to the cluster head. On the other hand the cluster head checks the address of the cluster , if the address is related to its own address then it forward down to reach the destination otherwise it transfer the subsequent cluster head to reach the destination.

The addressing scheme used in this mechanism is unique for each cluster which will be used for data transfer and route discovery phase. Here the clusters are formed and maintained according to the following parameters: nwkMaxChildren(Cm) specifies the maximum number of child nodes a parent can have. nwkMaxRouters(Rm) specifies the maximum number of child nodes present under a router node. The address for each node in the network is assigned according to the formula specified in the equation 2 and 3 where d is the depth of the network and m specifies the number of routers present in the network. The variable Cskip (d) specifies the size of address at depth d, k A represents the child at k-th router and n A specifies n-th end device child

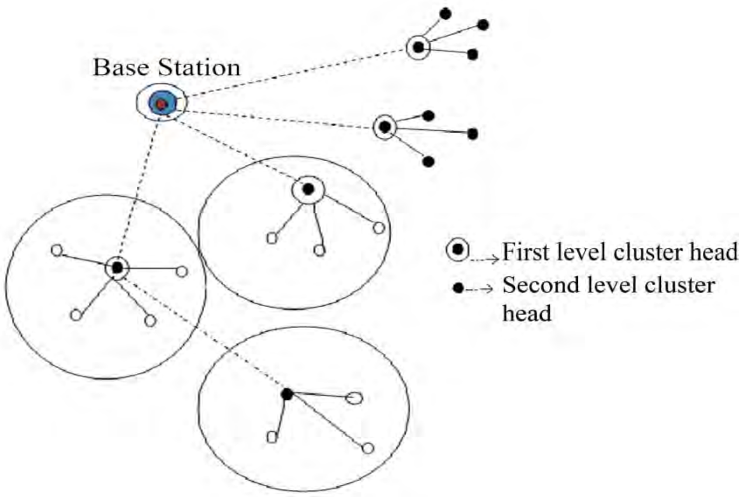

Fig: 1: Cluster tree network

$$cskip(d) = \begin{cases} 1 + C_m(Lm - d - 1), & if\ R_m = 1 \\ \dfrac{1 + C_m - R_m - C_m \times R_m{}^{Lm-d-1}}{1 - R_m}, & otherwise \end{cases} \quad \ldots\ldots(1)$$

$$A_k = A_{parent} + cskip(d).(K-1) + 1, (1 \leq K \leq R_m) \ldots\ldots\ldots\ldots(2)$$

$$A_n = A_{parent} + cskip(d).R_n + n, (1 \leq n \leq C_m - R_m) \ldots\ldots\ldots\ldots,(3)$$

The chosen system has the higher figure of nodes in the way of destination. As each node is equipped with digital maps, it knows the position of neighbor mantes. The position of destination is available by using location services, so, the forwarding nodes knows the Manet which is closest to the purpose and this Manet is chosen as destination Manet. Forwarding nodes then events distance from each Manet to the destination nodes.

$$(N_j): \alpha \times \lfloor 1 - D_p \rfloor + \beta \times \lfloor T \rfloor$$

Where

$$D_p = D_n / D_c$$

We are able to have two luggages for the worth of D_p .

When

$$D_p < 1, => \alpha \times \lfloor 1 - D_p \rfloor > 0$$

Plus this will result inside optimistic score,

$$D_p > 1, => \alpha \times \lfloor 1 - D_p \rfloor < 0$$

And this wills consequence in unhelpful score. The worth of N_j determines the closest Manet. Consequently, D_p plays a significant role and represent the Manet which is biologically closest to the purpose Manet. Forward nodes in addition measure the node traffic compactness as of current Manet to each fellow citizen Manet. T represents the total numeral of nodes moving from in progress Manet to national Manet which represent the directional density. The computation of directional density will be described in next section. The score is set for every Manet by using the formula:

$$(N_j): \alpha \times \lfloor 1 - D_p \rfloor + \beta \times \lfloor T \rfloor$$

Where α and β are the weighting factors having worth 0.5 each. The Manet with uppermost score is select as next purpose Manet, which is also in nature closest Manet to the destination. The improved Manet selection instrument selects J3 in its place of selecting J2 as a next end Manet on the basis of transfer density in the course of destination. After selecting J3 as a next purpose Manet, improved Manet assortment mechanism avoids the local utmost problem which occurred when selecting J2 as a next purpose Manet.

The chosen system has the higher figure of nodes in the way of destination. As each node is equipped with digital maps, it knows the position of neighbor mantes. The position of destination is available by using location services, so the forwarding nodes knows the Manet which is closest to the purpose and this Manet is chosen as destination Manet. Forwarding nodes then events distance from each Manet to the destination nodes. Selecting Manet having highest transfer density in the way of destination has two damages. Initially, forwarding nodes can easily discover the neighbor as enhanced Manet assortment mechanism selects the Manet having uppermost traffic density in the route of destination.

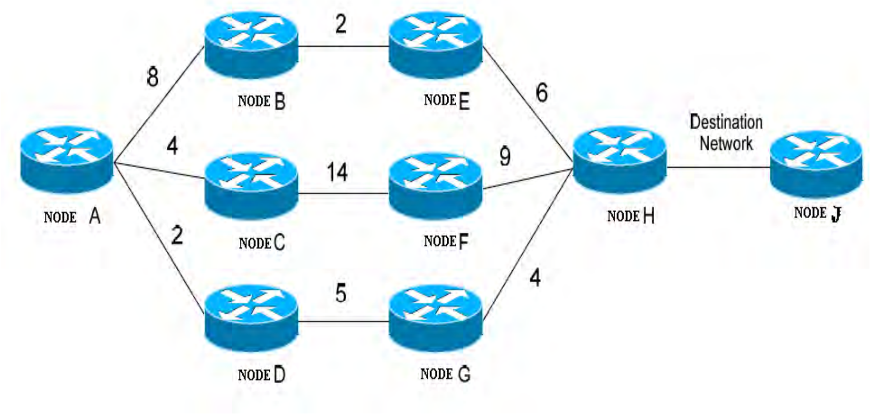

Fig: 2: Sampling Network Model in E-NAODV

To reduce the back-to-back delay and secondly, enhanced Manet assortment apparatus increases the chance of connectivity and also reduces the numeral of packet missing due to connectivity problem which will ultimately increases the small package delivery relative amount.

IV.E – NAODV ROUTING ALGORITHM

Step 1: Initialize the network topology

Step 2: NM: Nano Machine

BS: Base Station, initialized as an empty list

Destination node

AR=Active Route

PR=Passive Route

Step 3: Nano machine or Source node send all data in to base station

If BS (empty) store data

Return n

End if

Step 4: Base station is to decide the Active route and passive route.

IF (BS=full)

Packet will be send in active route

Else

Data will be send in passive route

Step 5: In active route and passive route, during packet transmission data loss means to choose direct path or shortest path in network.

IF (AR, PR= No data loss)

Continuously data will be sending

Else

Choose direct path or shortest path

Step 6: All the data will be send in to the correct destination in efficient manner

V. EXPERIMENTAL SETUP

In order to analyze the performance of the proposed routing algorithm we used NS-2 simulator. The execution approved using a cluster environment of 19 wireless mobile nodes and the total nodes we considered 71 over a simulation area of 1200 meters x 1200 meters level gap in service for 10 seconds of simulation time. Then also used into MAC layer models. The sources create multiple packets and its sending to the destination node; each data has a steady size of 512 bytes. The simulation configuration environment is given in table 1.

TABLE I
Simulation configuration settings

Parameter	Value
Simulator	Ns-2
Protocols	E-NAODV
Area	1200m x
Broadcast	250 m
Transfer	UDP (CBR)
Data size	512 bytes

VI. PERFORMANCE ANALYSIS

The important routing performance metrics considered here are throughput, packet delay packet delivery ratio, energy consumption and network density. The main objective of this paper is to evaluate the routing performance and also to increase the performance ratio of E-NAODV compared to O-NAODV. The simulation results are given in table 2

TABLE II
Simulation results

S.No	Protocol	Number of Nodes	Throughput	Average delay	PDR	Energy
1.	NAODV	71	0.67	20.05	95.2	22joule
2.	O-NAODV	71	0.78	15.5	97.0	19joule
3	E-NAODV	71	0.89	12.1	98.1	12joule

The following ratio graphs shows how the new routing protocol E-NAODV performs when compared with our previous work O-NAODV protocol.

A. *Throughput*

The throughput is the amount of data delivered in unit time .The comparison between O-NAODV and E-NAODV is shown in figure 3.

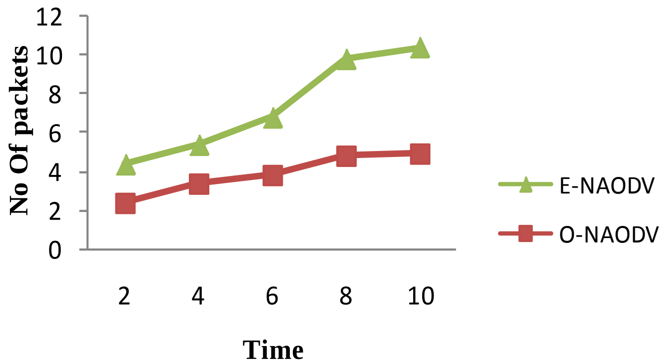

Fig: 3: Throughput level

B. *Average delay*

The delay is the time between when a data packets message (CBR data packet) was sent by source and when it was received by the destination is represented in figure 4. Here we have using a shared buffer model for reduce the network delay and avoid the traffic on network, so we have a better result compare with existing method.

$$D = (Tr - Ts)$$

Where Tr - receive Time and Ts -sent Time

$$\text{Average end to end delay} = \sum (time_{received} - time_{sent})$$

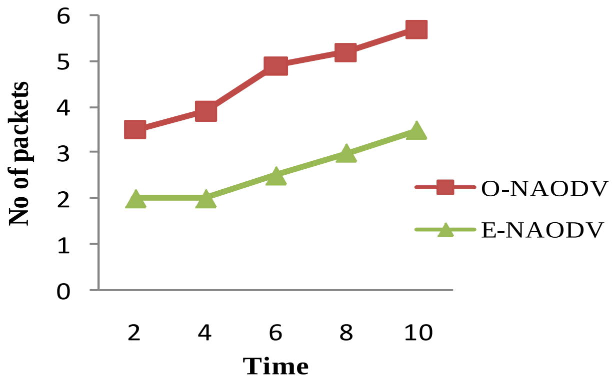

Fig 4: Overall delay

C. *Packet delivery ratio*

This is the ratio of total number of packets successfully received by the destination nodes to the number of packets sent by the source nodes throughout the simulation which is shown in figure 5.

PDF = (Pr/Ps)*100

Where Pr is total Data received & Ps is the total data sending on their network.

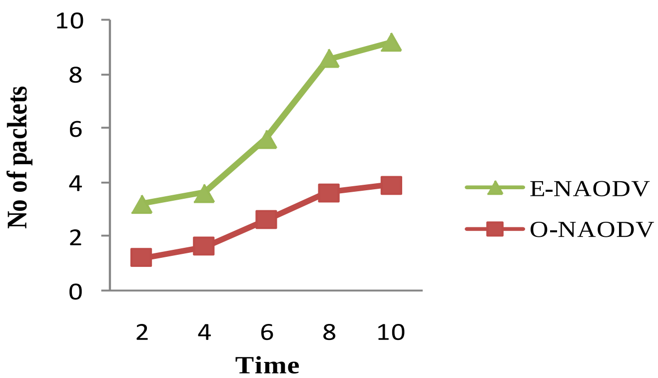

Fig.5. Packet delivery ratio

D. *Energy consumption*

The energy level on the network is most important one of the quick data transmission on their network. It is calculated from each node for the networkwhich isin given in figure 6. If any node none to data transmit that node to save the energy on the network the cluster head take more energy to send the data from source to destination on the network.

Energy consumption = No of packets * Initial energy level

Remaining energy = Energy consumption – No of packets in node

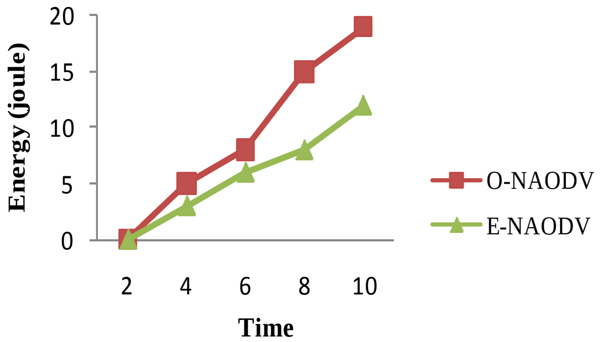

Fig 6: Energy consumption

E. *Network density*

Network density shown in figures 7 describes the portion of the *potential* connections in a network that are *actual* connections. A *"potential connection"* is a connection that could potentially exist between two "nodes"

Network Density= Actual connections/Potential connections

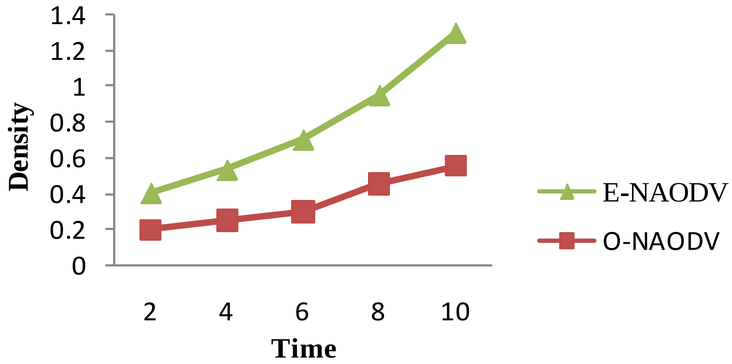

Fig 7: Network density model

VII. Conclusion

In this paper we analyzed the performance of the new routing algorithm E-NAODV by considering various parameters. The number of nano nodes in nano network is also a critical parameter for the performance analysis. The increasing number of nano nodes increases the connectivity in the network. Therefore, the message can be delivered to an infostation in a lower time using E-NAODV. Furthermore, in the energy utilization point of view E-NAODV behaves well as well as in throughput improvement also. This simulation scenario is calculated particularly in the direction of assess the impact of network concentration on the presentation of the network protocols. Simulation results show that E-NAODV performs better than O-NAODV.

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